Jan. 9, 1951 E. F. WILLIAMS ET AL 2,537,290

FAST SPEED FLUID TREATMENT OF RUNNING LENGTHS OF FABRICS

Original Filed July 26, 1944 4 Sheets-Sheet 1

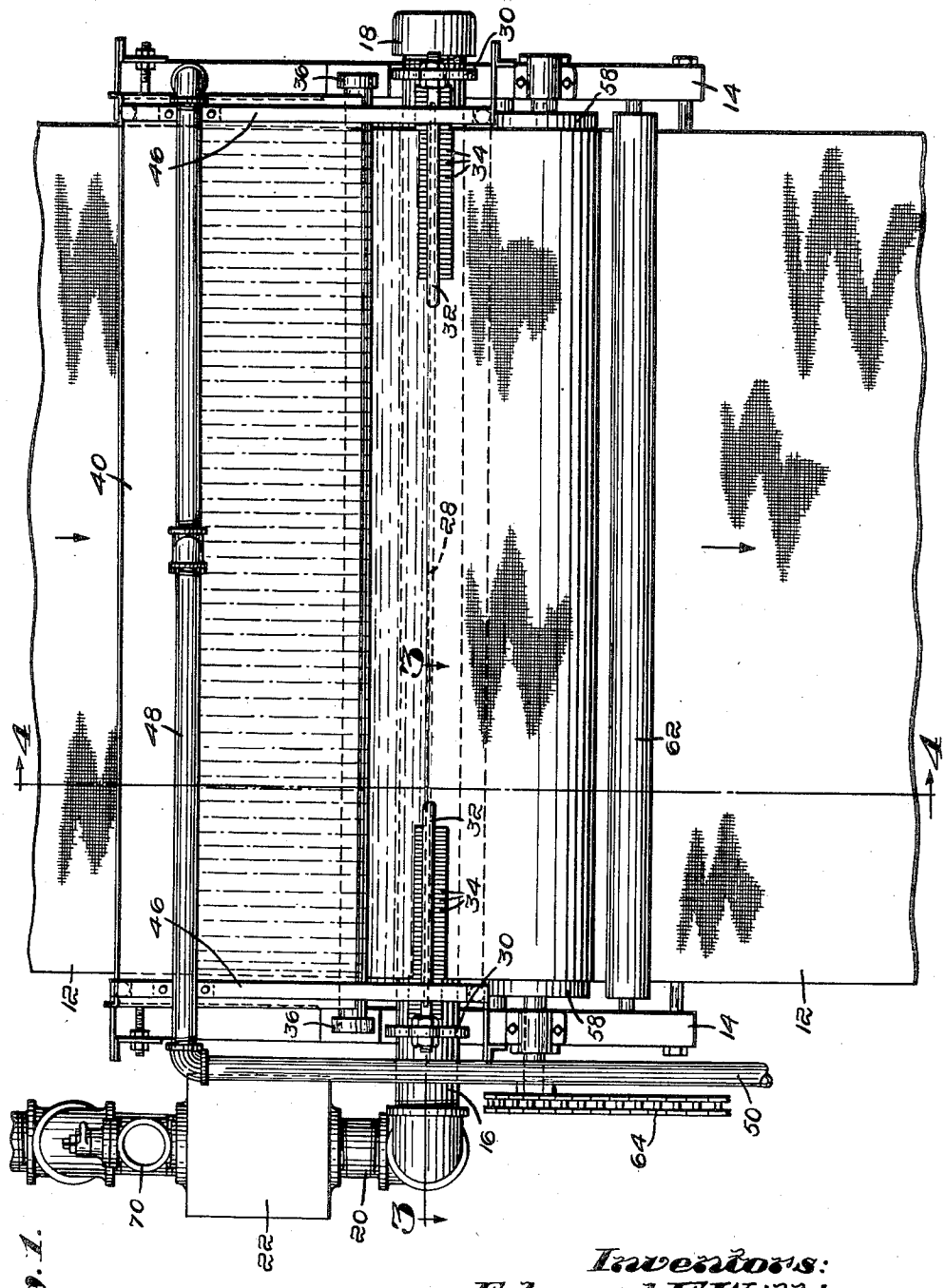


Fig. 1.

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Fig. 3.

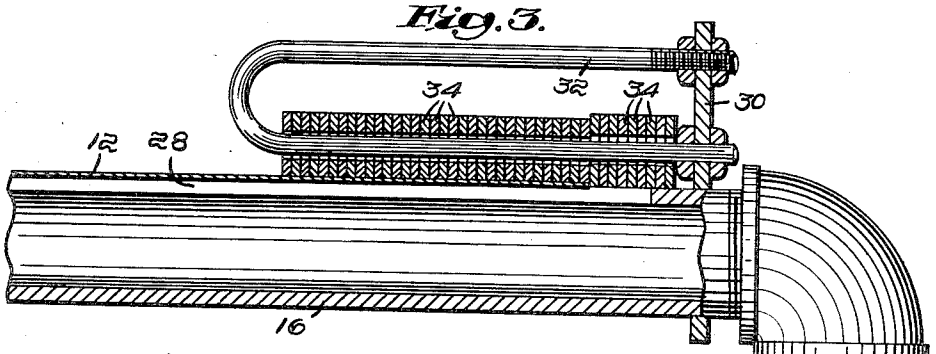
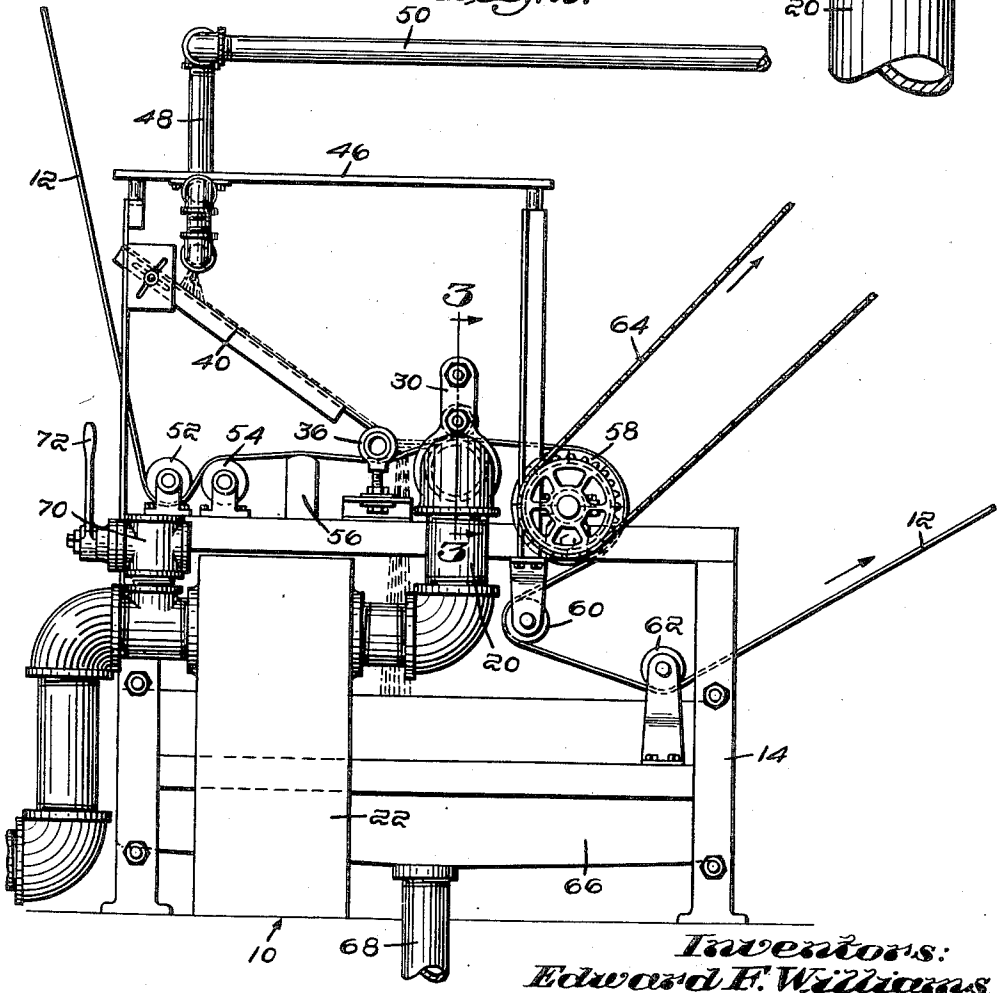


Fig. 2.



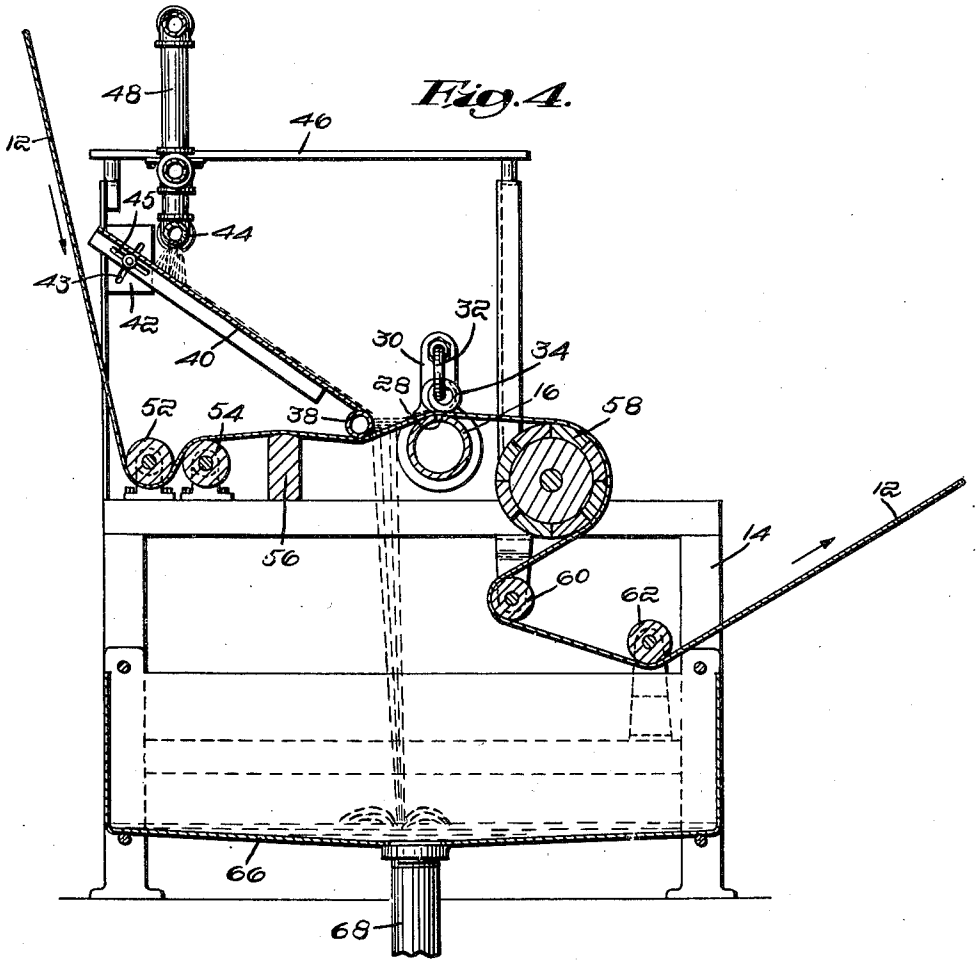
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FAST SPEED FLUID TREATMENT OF RUNNING LENGTHS OF FABRICS

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Fig. 4.



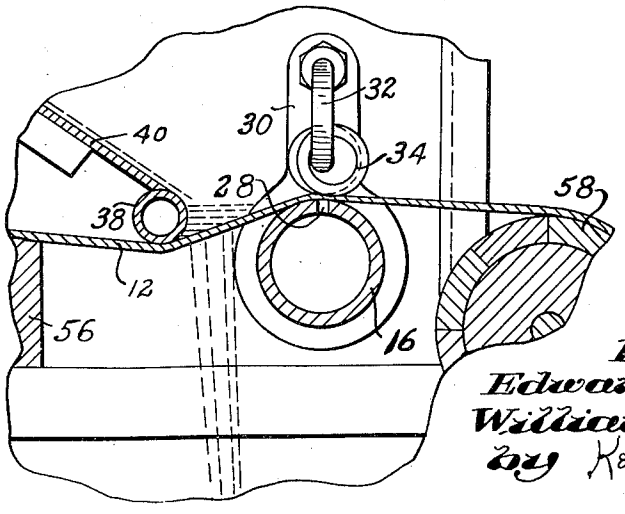


Fig. 6.

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FAST SPEED FLUID TREATMENT OF RUNNING LENGTHS OF FABRICS

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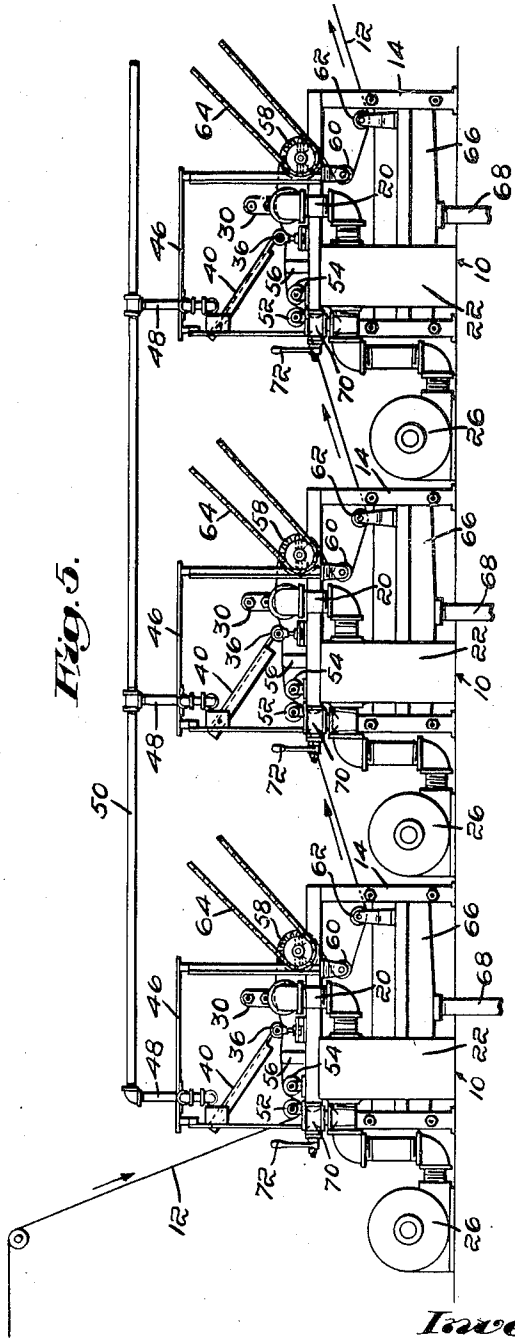


Fig. 5.

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UNITED STATES PATENT OFFICE

2,537,290

FAST SPEED FLUID TREATMENT OF RUNNING LENGTHS OF FABRIC

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Continuation of application Serial No. 730,122, February 21, 1947, which is a division of application Serial No. 546,716, July 26, 1944. This application filed November 23, 1949, Serial No. 129,086

2 Claims. (Cl. 8—151)

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This invention relates to a method for continuously treating strip fabrics in open width with treating liquids for various purposes as, for example, washing or wetting of fabrics, neutralizing previously treated fabrics, dyeing, etc. The invention contemplates the continuous movement of strip fabric longitudinally and in open width at substantial speed along a predetermined path and simultaneously therewith treating the fabric, preferably progressively at relatively spaced zones therealong, by maintaining a pool of treating liquid on one face of the fabric at each zone, continuously drawing from the pool a uniform layer of treating liquid on said face of the fabric in the direction of movement of the fabric to a relatively narrow area disposed transversely across the fabric adjacent to and along the fabric exiting edge of the zone, maintaining a high vacuum at the opposite face of the fabric along said area, solely against the atmosphere, the fabric and the liquid continuously brought to said area by said layer, forcing said layer of liquid continuously through the fabric at high speed by said vacuum, and constantly supplying make-up liquid to the pool to maintain a constant depth of liquid in constant contact with the fabric at each zone. The primary object of the invention resides in the production of an improved method for thus continuously treating fabrics.

The invention more particularly concerns the washing of fabrics in strip form and in taut open width condition leaving the fabric free of wrinkles and preferably requiring the penetrating of only a single thickness of the fabric. Heretofore, newly manufactured fabrics have been first fulled by treating in various baths to remove dirt, dissolve grease, etc. and then washed and scoured in machines known as "Dolly" washers. These machines each wash about three hundred yards of fabric at a batch, the fabric being folded or lapped both laterally and longitudinally into a doughnut-like roll which is continuously run through a washing bath and heavy squeeze rolls for a period of three hours for each batch. This method of procedure not only requires tons of water for each batch together with great quantities of soap and a considerable time period but, furthermore, stretches and places considerable wear on the fabric and leaves it in an unattractive and wrinkled mass condition injurious to the finish and quality of the final product. A further object of our invention resides in the production of an improved process for washing the fulled fabric continuously in open width condition with a uniform and minimum amount of wash water passed at high speed but once through the fabric and requiring no additional soap, whereby keeping the fabric flat and the fibres round and intact, substantially as they left the fulling mill, and eliminating the objectionable features above pointed out, and all at substantially less expenditure of time, labor and materials than has been heretofore possible.

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Our invention contemplates a rapid, uniform and thorough treatment of the fabric and such treatment requires an ample surplus of water or other liquid from which to draw a full, uniform and continuous supply of treating liquid, and the passage of the liquid through the fabric at such high speed as will remove all dirt particles and effect a thorough and uniform treatment. The maintaining of the pool of liquid on the fabric provides this required surplus of liquid from which a uniform layer is continuously drawn on the traveling fabric, and the high vacuum acting directly and solely on the fabric and liquid together with a minor portion of atmosphere serves to perform these functions with a speed, thoroughness and uniformity never approached by any method heretofore known. The production of an improved fabric treating method embodying these novel features comprises a further object of the invention.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof selected for purposes of illustration and shown in the accompanying drawing in which,

Fig. 1 is a plan view of one unit of a machine for practicing our invention,

Fig. 2 is a side elevation thereof,

Fig. 3 is an enlarged fragmentary sectional view taken on lines 3—3 of Figs. 1 and 2,

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1, and

Fig. 5 is a side elevation of the machine comprising a battery of units.

Fig. 6 is an enlarged fragmentary view of Fig. 4 more particularly showing the relation of the vacuum slot 28 to the pool of liquid on the fabric.

The machine shown in the drawings is preferably constructed in independent units 10 and operated in the form of a battery comprising a plurality of units in aligned relation as illustrated in Fig. 5. The fabric 12 to be treated is passed in flat open width into and through the units along a predetermined path where it is treated progressively at the units in the manner hereinafter described.

Each unit 10 embodies a frame 14 on which is carried a relatively large pipe 16 closed at one end 18 and having its other end connected by a pipe 20 to a separating chamber at 22. Pipe 24 connects the chamber to a water sealed vacuum pump 26 arranged to produce a vacuum in the chamber and pipes. The pipe 16 is slotted longitudinally along its top portion at 28. Mounted on each end of the pipe 16 is a plate 30 supporting an inwardly extending U-shaped rod 32 having a plurality of ring-like sealing elements 34 on its lower fork and in position normally bridging and sealing the slot 28.

As shown in Fig. 4, the rings are loose on the supporting rod 32 and these rings are provided only at the two margins of the fabric (Fig. 1). The function of the rings is two-fold. Where the rings rest on the fabric, the traveling fabric holds the rings to the right (Fig. 4) so that they rest on the exit margin of the vacuum slot, leaving the slot open forwardly thereof to receive the washing water. Where the rings rest on the pipe 16 outside the margins of the fabric they seat directly on and seal the vacuum slot. This is clearly shown in Fig. 4.

Supported on brackets 36 at its ends is a bar or pipe-like member 38 parallel with and located forwardly of and at an elevation slightly below the slot 28. A horizontally extending plate 40 has its upper portion supported on the frame at 42 and from thence is inclined downwardly with its bottom edge resting on the member 38. Slots 43 and 45 in the supporting brackets and plate permit angular adjustment of the plate to the desired inclination. Treating liquid is distributed on and along this plate from a perforated pipe 44 extending along and above the plate and supported by overhead bridges 46 on the frame, the treating liquid being supplied to the perforated pipe 44 of each unit 10 through a branch pipe 48 from a main supply pipe 50. The importance of the plate 40 is particularly emphasized since this plate serves the function of assuring a uniform and continuous distribution of the treating liquid first to the member 38 and from thence to the pool which forms on the fabric at the bottom of the plate.

The fabric strip to be treated first passes to the machine beneath and in contact with a guide roll 52 and over and in contact with a roll 54. From thence the strip passes into contact with and is guided by the following elements: top surface of an abutment bar 56, bottom surface of the member 38, slotted portion of the pipe 16, about a power driven drum 58, and outwardly over guide rolls 60 and 62. The drum 58 is driven in any convenient manner as by a chain 64.

The fabric, supported in open width on the rolls and surfaces illustrated, is drawn taut by the drum 58 which is adapted continuously to move the strip longitudinally in the direction of the arrow. The strip is in substantial sealing contact with the bottom of the member 38 and the surface bordering the slot 28 and that portion of the strip disposed therebetween forms the bottom inclined wall of a basin of which the

member 38 provides a side wall, the ends of the basin being open. Wash water or other treating liquid is distributed on and along the plate 40 from the perforated pipe 44 and flows gently and uniformly down the plate to the fabric. The flow of liquid is sufficient to maintain substantially the level illustrated in the drawing, the surplus liquid overflowing at the ends of the basin and into a pan 66 from which it passes to a drain 68.

Such a full and uniform flow of liquid providing a continuous body on and across the fabric is essential to the successful operation of our invention for the purpose of securing the mechanical penetrating and cleansing action that only a full and continuous supply of liquid can produce and also for the purpose of providing a solid body of liquid against which a heavy vacuum can be maintained. The very strong mechanical action thus produced and effecting a rushing passage of the liquid through the fabric serves uniformly to clean and remove foreign matters at a rate and efficiency heretofore impossible. It will be apparent that failure thus to cover the fabric across its entire width adjacent to and along the dam at the slot 28 would cause unevenness in the amount of foreign matter removed from the fabric and uneven coloring and finishing effects in the fabric. The essential importance of flowing and maintaining a body of the treating liquid uniformly on and across the fabric as herein described and claimed is therefore particularly emphasized.

The fabric is moved longitudinally at a substantial speed and carries a uniform layer of the water from the basin to the zone of the slot 28 where the water is drawn downwardly through the fabric. The vacuum maintained solely against the fabric and water at the slot together with a minor portion of atmosphere at the fabric exiting margin of the slot ordinarily approximates 20 inches although it will necessarily vary with the weight and texture of the fabric being treated, heavy felted fabric being adapted to produce a relatively greater vacuum. In any event the water is drawn through the fabric at a speed and in such quantity as thoroughly to impregnate the fabric and give it a thorough washing to remove foreign matter and impurities. The water is preferably heated to a moderate temperature but no soap is added. The foreign matter, having been loosened by the fulling of the fabric and kept in soft condition by the soap remaining therein, is readily removed by the forceful passage of the water through the fabric. As illustrated in Fig. 4, the vacuum slot 28 is quite narrow, relative to the pool of water, and is located at the fabric-exiting edge of the treating zone. The narrow slot together with the vacuum maintained within the pipe 16 effects a rush of water through the fabric of sufficient force and volume to clean and remove foreign matters uniformly at a rate and efficiency heretofore impossible and the locating of the slot at the exiting margin of the treating zone effects such total removal of the water at that location as to leave a minimum amount of dampness in the fabric. The water drawn into and through the pipe 16 is passed on to the separating chamber 22 from whence it passes into a drain.

It is quite apparent that the impregnating and cleansing action effected on a fabric by the vacuum slot treatment at one face depends upon several factors, including not only the passage

of water through the fabric but furthermore upon the creation of a very strong mechanical action or rushing of water and air therethrough to pick up and remove foreign particles, soap and emulsified matter from the fabric. Our invention employs a process that utilizes this principle to the maximum degree and has maximum cleansing and drying effect on the product.

The pool provides a reservoir from which the traveling fabric can draw the required amount of water to be passed through the fabric and vacuum slot. Locating the pool forwardly of the slot provides for a free and full flow of water to the fabric at the slot but without fully sealing the slot against the passage of a film of air through the fabric along with the water. This film of air passes through the fabric and slot at and along the exit margin of the slot and therefore serves to dry the fabric as it leaves the slot. The relative proportions of water and air thus passing through the fabric will depend upon various factors, including the character of the fabric, the level elevation of the pool, the extent of vacuum maintained, the width of the vacuum slot, etc. It will be apparent that in practicing the invention these factors will be properly co-ordinated to produce the desired results. In any event the process and apparatus effect a maximum impregnating, cleansing and drying of the fabric as it passes over the vacuum slot.

As illustrated in Fig. 5, the machine preferably employs a plurality of units at each of which fresh wash water is drawn through the fabric whereby progressively washing it to a predetermined degree of perfection. The fabric is furthermore washed with great uniformity, laboratory tests having shown less than .1% variance across the piece and less than .5% average over all. This uniformity in the fabric eliminates uneven dyeing and redyeing of the fabric. Sewage troubles are also non-existent in our process due to the small amount of water used. A valve 70 in communication with pipe 24 is provided for relieving the vacuum when occasion requires, the valve being operated by a handle 72.

The machine battery shown in Fig. 5 has been constructed and operated very successfully in production work. The fabric has been run through the machine at a speed of 40 to 50 yards per minute and the water consumed has been 43 gallons per piece of 24 oz. fabric of 60 yards length. Intermittently operating washers heretofore employed wherein the fabric is intermittently moved forwardly 27 feet and rearwardly 10 feet through a washing bath has required 1200 gallons of water per piece of 24 oz. fabric of 60 yards length and has completed its washing functions at a speed of 22 yards per minute. The work performed by such washer which employs a soaped washing bath and scrubs the fabric however cannot be compared to the greatly superior work performed by our process and the very substantially improved resulting product. Furthermore, the costs in time, materials and mechanical upkeep have been very substantially reduced by our invention.

It should be understood that, whereas our method is capable of washing fabrics at a fast speed in the range of and exceeding 40 to 50 yards per minute, successful operation of the method is not dependent on the speed employed. We employ the term "fast speed" herein to define a speed of travel of the fabric which ordinarily will be in the neighborhood of 40 to 50 yards per minute but which will depend on other factors such as the degree of vacuum maintained, the density of the fabric being treated, etc.

Fabrics to be washed by our process can be fulled with 1 oz. soap to produce clean washing and scouring, and grease and oil stains which have been troublesome in prior known methods are eliminated by our invention. Furthermore, the fabric remains flat at all times and washer wrinkles are non-existent.

While our invention is particularly applicable to the washing of fabrics as above described, it is also useful in other treatments of fabrics, such as, for example, (1) for operating on goods that have been treated with paint remover, (2) the wetting out of goods for fulling, (3) the neutralizing of carbonized goods, (4) dyeing etc.

In certain operations it is desirable or necessary to give the fabric a special treatment prior to passing it through our machine and in such cases the fabric in full width form is passed through a treating bath on its way to the washing treatment, a tank for this purpose being provided forwardly of the machine. The fabric can be washed before or without fulling if desired by first soaping it in this tank or otherwise and then scouring by running it through the machine. In the neutralizing treatment the fabric is thus passed through a prescribed solution of alkali or soda on its way to the washing machine, the bath tank being located to the left of Fig. 5. The fabric is continued from the treating bath to and through the washing treatment. The process leaves the fabric ready for future processes such as fulling, coloring or other steps in finishing and the uniformity of the treatment throughout the length and breadth of the fabric is of especial advantage in such further process treatments through which the fabric is passed to the finished product.

This application is a continuation of our application Serial No. 730,122, filed February 21, 1947, which is a division of our prior application Serial No. 546,716 filed July 26, 1944, now Patent No. 2,426,806.

Having thus described our invention what we claim as new and desire to secure by Letters Patent of the United States is—

1. A method of treating fabric which comprises continuously moving a strip of fabric at fast speed longitudinally in open width and taut condition past a treating zone, the path of movement of the fabric at said zone being inclined upwardly in the direction of movement of the fabric to a relatively narrow area disposed transversely across the fabric adjacent to and along the fabric exiting edge of the zone, maintaining the fabric in close contact with the top margin of said area, maintaining a pool of treating liquid of substantial depth in direct contact with the upper face of the fabric at said zone, continuously drawing from the pool to said area a uniform layer of liquid on said face of the fabric in the direction of movement of the fabric, maintaining a high vacuum at the opposite face of the fabric along said area solely against the atmosphere, the fabric and the liquid continuously brought to said area by said layer, continuously forcing said layer of liquid directly through and transversely of the fabric at high speed at said area by said vacuum, and constantly supplying make-up liquid to the pool to maintain a constant depth of liquid

in constant contact with the fabric at said zone.

2. The method defined in claim 1 characterized by the forcing of said treating liquid through the fabric at a forward major portion of said area and the forcing of a film of fabric drying air through and entirely across the fabric at a rearward minor portion of said area at the fabric exiting margin thereof by said vacuum simultaneously with the forcing of said liquid through the fabric.

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